

***Appendix D2***  
***Anchor Mitigation Plan for Horizontal***  
***Directionally Bored Nearshore Pipeline***  
***Project Marine Operations***

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***AVAILABLE ON CD ONLY***





Project Title: <b>CABRILLO PORT LNG TERMINAL</b>	Subject: <b>Anchor Mitigation Plan for Horizontal Directionally Bored (HDB) Nearshore Pipeline Project Marine Opns</b>
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**ANCHOR MITIGATION PLAN  
for  
HDB Nearshore Pipeline Project  
Marine Operations**

**BHPB Document No. WCLNG-BHP-DEO-TX-00-001-1  
Marine Project Management, Inc.  
Document No. 514B**

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## **1 INTRODUCTION**

BHP Billiton (BHPB) has submitted applications to acquire federal, state and local permits and approvals for the Cabrillo Deepwater Port Project, a Floating Storage and Re-gasification unit (FSRU) which will be sited in federal waters approximately 21 miles offshore of Port Hueneme, CA. Two new 24-inch diameter pipelines will deliver the restored natural gas product from the FSRU into the existing onshore natural gas pipelines owned by Southern California Gas Company. The new 24-inch diameter submarine pipelines will transit onshore via a horizontal directionally bored (HDB) pipeline crossing to landfall sites located either at Reliant Energy Ormond Beach or at the alternate Navy site. The objective of this document is to provide an Anchor Mitigation Plan which minimizes effects to the seafloor while providing the necessary moorings to conclude the HDB scope of work. The proposed Anchor Mitigation Plan described herein is based on well established local marine practices which are routinely employed for West Coast subsea projects.

West Coast project vessel operators are familiar with anchor mitigation requirements and the enclosed procedures, as they have been operating in support of offshore energy, military and scientific operations for many years. Projects have included facility inspections, submarine power cable and pipeline installations and repairs, as well as geotechnical surveys and other research projects conducted on behalf of numerous federal and state agencies, including the U.S. Minerals Management Service, U.S. Navy, National Oceanic Atmospheric Administration and California State Lands Commission. These operations have included construction support that typically requires anchoring to provide a safe, stable work platform. Geographical areas of operation have primarily been within the Santa Barbara Channel, Santa Maria Basin and San Pedro Bay.



This Plan includes procedures for the installation and recovery of project barge moorings as well as the installation and recovery of temporary pre-set moorings. The barge mooring arrangement and temporary pre-set mooring arrangement depicted in Section 4 is a typical plan for project work barges which include either the nearshore / HDB pipelay equipment barge or the exit hole barge; two temporary pre-set moorings have been included for support vessels that may move on and off location as required. The temporary pre-set moorings are utilized to minimize the number of anchoring operations that otherwise would have been required for project support vessels. The work barge(s) and temporary pre-set moorings shown in the drawing in Section 4 are typical locations which may be amended once the contractor and marine equipment spreads have been selected. The final anchor pre-plot plan will be submitted at a later date.

All anchor deployment and recovery operations will be performed during daylight hours using surface navigation to ensure accuracy. The use of Differential Global Positioning System (DGPS) navigation ensures that anchors will be located within +1.5 meter accuracy or better. Using DGPS navigation ensures that anchors will be set at their planned coordinates as depicted on the pre-plot drawings, thereby eliminating repeated anchoring events and successive seafloor disturbance. It is important to note that initial bathymetric surveys have not identified any hard bottom habitats or other resources that would be substantially impacted during anchoring operations. Additionally, as prescribed by regulation and directive, the U.S. Coast Guard, and other interested parties including the Joint Oil Fisheries Liaison Office (JOFL) will be notified of the location of project moorings.

Additional project data can be found within supplementary HDB studies including, "Horizontally Directionally Bored Nearshore Pipeline Marine Operations", BHPB document number WCLNG-BHP-DEO-TX-00-002-2, which details the typical marine equipment spread(s) and operational functions necessary to conclude the HDB marine operations, "Preliminary Geotechnical Study Summarizing Subsurface Conditions at Southland Sod Farms", BHPB document number WCLNG-BHP-DEO-GR-00-216-0 which examines typical subsurface conditions at the HDB site. Construction procedures for the HDB operation are described in "Preliminary Construction Procedure and Design for Horizontally Directionally Bored Pipeline Landfall", BHPB document number WCLNG-BHP-DEO-TP-00-0001-2, and the proposed drilling fluid monitoring plan is described in "Drilling Fluid Release Monitoring Plan for Horizontal Directional Boring", BHPB document number WCLNG-BHP-DEO-TX-00-001-4.

## **2 OPERATIONAL FUNCTION**

The Anchor Mitigation Plan has been designed to minimize seafloor impacts from anchoring operations required to accomplish the HDB scope of work.

## **3 PROJECT DESCRIPTION**

### **3.1 GENERAL DESCRIPTION**

The objective of this plan is to provide a guide for vessel anchoring operations at the proposed HDB site(s). The Anchor Mitigation Plan serves to minimize impact to the seafloor from anchoring operations, while providing the necessary moorings required to conduct safe operations.





### 3.2 EQUIPMENT DESCRIPTION

Descriptions of equipment utilized during anchoring operations are provided within this Section, as follows:

#### 3.2.1 Project Vessels

Multiple vessels will be utilized during the project, and will typically comprise two work barges, materials barges, and tug and supply vessels. Only those vessels that require mooring operations are addressed within this Plan, as follows:

- **Work Barges** – Work barges must be anchored onsite to provide a stable platform from which project operations can be conducted. Work barges include the nearshore / horizontal directionally bored (HDB) pipelay equipment spread barge and the exit hole barge. The nearshore / HDB pipelay barge typically will be approximately 400-feet length overall (LOA), with up to an 8-point mooring system complete with ten-ton anchors. The exit hole barge will range from approximately 220 to 400-feet LOA with up to a nine-point mooring system complete with ten-ton anchors. The barge's onboard moorings may be installed with assistance from the Anchor Handling Vessel (AHV) and / or the Anchor Handling Towing/Supply (AHTS) vessel.
- **Anchor Handling Towing/Supply (AHTS) Vessel** – The AHTS vessel typically will be utilized to install all temporary pre-set moorings identified in the anchor pre-plot drawings. A sample configuration drawing has been provided in Section 4. AHTS's are purpose-built for mooring system installations / removals as they are equipped with high load capacity anchor handling winches which are operated from the vessel bridge adjacent to the vessel captain and the navigator stations to ensure safety and efficiency. Further, AHTS's are equipped with deck fairleads, tuggers, pop-up bits, and a stern roller specifically designed for anchor handling operations. Typical West Coast AHTS's are 190-feet to 225-feet LOA, up to 15,000 BHP with 150 to 200 ton capacity anchor handling winches.
- **Anchor-Handling Vessel (AHV)** – The AHV typically will be utilized to run the barge's onboard anchors and to support the survey and sampling equipment and personnel as required throughout the project. Typical West Coast anchor-handling vessels for barge support are 100-feet to 185-feet LOA with horsepower ranging from 4,000 to 6,000 BHP.

#### 3.2.2 Navigation Equipment

The Fugro STARFIX positioning specifications for anchoring operations are as follows.

- **Vessel Positioning** – Positioning of the vessel will be accomplished through the utilization of DGPS and integrated navigation software. The Fugro West software is operated on a Pentium shipboard computer that serves as a controller for a variety of input/output devices. The differential method of using GPS will be a viable way of enhancing the accuracy of the GPS over the project area. Real-time corrections will be transmitted via dedicated satellite transponder to the vessel.

The corrections themselves are pseudo-range corrections and range-rate corrections for every satellite in view. The GPS base stations that collectively comprise the Wide Area Differential (WAD) network are located throughout North America. These base stations make real-time differential observations of the GPS satellite constellation in their view. The differential data is

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then modemed to the STARFIX control center located in Houston, Texas at the Fugro STARFIX Division office. At the control center, the data is further enhanced by applying corrections for ionospheric and tropospheric corrections. The enhanced data is then uplinked to a dedicated communication satellite transponder where it is simultaneously transmitted to the vessel. On board the vessel, a dedicated WAD computer compiles received time tagged data with the vessel's GPS position and outputs the DGPS position to the navigation computer.

This method of transmitting WAD requires no local base station, has no radio range or line-of-sight considerations and will produce a position in the order +1.5 meter accuracy or better. Furthermore, the update rate of this method is in the order of 1.5 to 2 seconds and has a very high reliability rate. Additional input data including vessels heading information from the compass will be logged at every fix mark. The computer logged position information will be stored on disk and will also be backed up by hard copy print out. Position fix marks will be generated from the computer system at the desired intervals along pre-plotted track lines for the survey.

Fugro will utilize the Hypack for Windows PC based navigation system. The system has the capability of interfacing DGPS positions of latitude and longitude and converting them to the appropriate California State Plane coordinates as necessary. One of the systems strengths is its ability to import AutoCAD generated maps and charts and have them depicted on several graphics display monitors that can be stationed throughout the vessel. The graphic monitor displays a scaled depiction of the vessel orientation to the survey lines and or subsurface targets, range and bearing from the vessel's antenna to the target. The navigator can control the scaling of the graphics to assist the vessel helmsman in fine tuning the vessel position.





### 3.3 BARGE ANCHORING PROCEDURES

The barge's anchors typically will be set in pre-determined locations utilizing the anchor pre-plot drawing. The barge captain, navigator, and the anchor handling vessel captain will determine the order in which anchors are set, dependent on onsite weather conditions. A typical anchor pre-plot drawing (without anchoring coordinates) which depicts anticipated mooring configurations is included in Section 4 of this document. The final project anchor mitigation plan and pre-plot drawing is dependent upon contractor and equipment selection, which will be determined at a later date.

Anchors typically will be set on position with the AHV. Using the AHV for all anchor sets, rather than attempting to move the barge to each anchor location, diminishes environmental impact to the seafloor by eliminating the risk of dragging an anchor on the seafloor.

The AHV will pull each anchor into position, one anchor at a time. To run an anchor, the AHV will come alongside the designated anchor and receive the anchor's crown line and buoy from the barge's deck crew. After securing the crown line, the boat will move to the position where the anchor is to be set.

The barge captain and/or project superintendent will supervise release of the anchor wire and operation of the winches as the anchors are placed into position.

#### 3.3.1 Operational Procedures

Coordination between the two vessels and crews are essential. The AHV follows certain procedures to perform various anchoring or towing tasks. These procedures have been itemized into two categories and are listed below:

##### 3.3.1.1 Running Anchors

Running anchors from the work barge shall be conducted as follows:

- The AHV pulls alongside the barge at the location of the anchor.
- The AHV crew is thrown a heaving line from the barge to which the crown line and crown line buoy is attached.
- The crew attaches the crown line to the vessel's towing bit or the towing winch. The bit and/or towing winch are welded to the deck at a point forward of amidships, allowing the vessel more maneuverability while towing.
- The anchor is pulled to a position dictated to the vessel captain by the navigator.
- Upon reaching the anchor location, the project superintendent will instruct the anchor handling vessel captain to release the anchor.

##### 3.3.1.2 Repositioning an Anchor

If weather conditions change, it may be necessary to reposition an anchor. Repositioning procedures are as follows:



- The AHV captain positions the vessel adjacent to the crown line buoy as it floats in the water.
- The AHV deckhand, utilizing a boat hook, retrieves the crown line and crown line buoy to the deck of the AHV.
- The crew attaches the crown line to the vessel's towing bit or the towing winch. The bit and towing winch are welded to the deck at a point forward of the propellers, allowing maneuverability of the vessel while towing or pulling.
- The anchor is pulled to its pre-plotted position as directed by the onboard navigator to the vessel captain.
- Upon reaching the new anchor location, the project superintendent will instruct the vessel captain to release the anchor.

### 3.3.2 Recovering an Anchor

Anchor recovery procedures are as follows:

- The AHV captain positions the vessel adjacent to the down weather crown line buoy as it floats in the water.
- The AHV deckhand, utilizing a boat hook, retrieves the crown line and crown line buoy to the deck of the vessel.
- The AHV crew attaches the crown line to the vessel's towing bit or the towing winch.
- The AHV captain will notify the barge captain and/or project superintendent that the anchor is attached to the towing winch.
- The AHV captain will pull away from the barge and lift up on the anchor.
- Barge captain and/or project superintendent will supervise recovery of the anchor wire and operation of the winches as the anchors are retrieved from position.
- The anchor is pulled to its anchor rack and the AHV releases the crown line.
- Barge deck personnel recover the crown line and buoy.
- The steps above are repeated for the balance of the mooring anchors.

### 3.3.3 Special Considerations

The AHV will remain onsite during all mooring operations.



### 3.4 TEMPORARY PRE-SET MOORING INSTALLATION AND RECOVERY PROCEDURES

Initial system installation and system re-sets shall utilize the following procedures in Section 3.4.1 to ensure that the system functions properly, and recovery procedures in Section 3.4.2 to safely recover the anchors at the conclusion of the project.

#### 3.4.1 Temporary Pre-set Mooring Installation Operations

All temporary pre-set components shall be located on the installation vessel, and procedures shall be implemented as follows:

- Pre-assemble system from anchor to dip section.
- Maneuver AHTS vessel to vicinity of anchor target area (clear of subsea facilities if applicable) and deploy anchor to within 15 feet of the seafloor. Pre-rig deck to deploy 90 to 110 feet of ground tackle rapidly.
- Maneuver vessel to pre-plotted anchor target location. NOTE – The AHTS vessel is NOT to attempt to power set the project specific moorings as an anchor could easily be dragged across the seafloor.
- Deploy anchor to seafloor and position within the target area, immediately log anchor coordinates, and deploy the balance of the pre-rigged ground tackle.
- Log coordinates and confirm that the system is within tolerance (<15% of water depth). If within tolerance, AHTS vessel deploys and releases balance of the mooring system, otherwise recover pre-rigged ground tackle rapidly to place the anchor ~15 feet above the seafloor and repeat the steps above until successful.
- AHTS vessel logs buoy at rest position, and set balance of systems pursuant to procedures above.
- AHV (Not the AHTS) will stern tie to mooring buoy, check position with DGPS to confirm it is within tolerance.
- Once the location is confirmed within tolerance, the AHV will power set the mooring in alignment with its intended pull direction to provide partial burial. This typically will be accomplished by increasing vessel power to ~30% while the navigator monitors position relative to buoy under tension location.
- Once on location and set, the AHV will log the buoy at rest position, and set balance of systems pursuant to procedures above.

#### 3.4.2 Temporary Pre-set Mooring System Recovery Operations

The AHTS vessel will recover the pre-set systems utilizing procedures as follows:

- Pre-rig anchor handling winch work wire with lasso wire and chain stopper at stern of AHTS.
- Maneuver AHTS to the mooring buoy.



- Lasso buoy and tension winch wire to bring buoy to stern.
- Maneuver at steerage way to mooring system heading.
- Navigator confirms that system is within tolerance (has not moved).
- Pull mooring buoy aboard barge and install chain stopper on underbuoy chain.
- Disconnect buoy from chain, move from winch/roller work area, and secure buoy (seafastened).
- Disconnect winch wire from buoy and re-attach wire to riser.
- Recover riser while maneuvering vessel toward anchor location

#### 3.4.2.1 Final Anchor Lift Procedures

The final anchor lift procedures must be executed to ensure minimum impact to the seafloor, as follows:

- Rig deck to recover 90 to 110 feet of ground tackle rapidly
- Ensure that the AHTS is in the pre-plotted anchor target location
- Recover pre-rigged chain rapidly while maneuvering AHTS over pre-plotted anchor location. Log lift-off coordinates.
- Continue maneuvering vessel over pre-plotted location and recover balance of system





#### 4 DRAWINGS

The drawing below provides a typical representation of the anticipated marine equipment anchoring locations required to complete the HDB installation operations. It also provides typical locations for two temporary pre-set moorings. Temporary pre-set moorings are utilized for the project duration to diminish seafloor impacts by providing a temporary mooring for project support vessels that may move on and off the project location. Anchor location coordinates will be provided once marine equipment spreads has been selected.

